IMAGE PROCESSING SYSTEM AND METHOD, AND IMAGE FORMING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to an image processing

5   system and method for detecting a specific pattern from the

image data, which is read out every pixel from an original

document image by an image input device, or the image data

received from communication means, and an image forming

apparatus.

10   Recently, an illegal copying preventing system is

proposed and applied to image forming apparatuses, such as

full-color copying machines. In the system, specific patterns,

e.g., two-dimensional codes, are buried in books, important

documents, securities or the like. The system recognizes this

15   pattern to prevent the illegal copying of those books or the

like, or the illegal use of them.

Generally, the copying machine reads image information

on an original document located at a given position, and copies

it at the size of the original or at a magnification level set

20   by the user. Accordingly, the unit for recognizing the

specific pattern in the copying machine can easily recognize

whether or not input image data has been magnified, and when

it is magnified, recognize a magnification level at which the

input image data has been increased in size, and hence it can

25   carry out a discriminating process on the basis of the

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magnification information.

A printer, unlike the copying machine, is connected to an external machine, e.g., a personal computer (abbreviated simply as a PC), and receives image data to be output from the external machine. Let us consider a case where an original document containing a specific pattern buried therein in advance is read by an image reader, such as a scanner, the image data read out is loaded into the memory of the PC, the image data is magnified by several %, and the resultant data is sent to the printer. In this case, a magnification of the image data is unknown to the pattern recognizing unit in the printer. Therefore, the pattern recognizing unit will mistakenly judge that the specific pattern in the magnified image data is different in size from the specific pattern to be detected, and will fail to recognize the specific pattern of the magnified image data as the specific pattern to be detected.

To prevent such a pattern recognition failure in advance, there are known magnification-estimating techniques, which are employed for an image recognition device for recognizing the specific pattern (the Unexamined Japanese Patent Application Publication No. Hei 9-81729 and the Unexamined Japanese Patent Application Publication No. Hei 10-126614). The technique disclosed in the publication of the Unexamined Japanese Patent Application Publication No. Hei 9-81729 uses a plurality of matching reference images, such as an image

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having an average or typical characteristic of a specific pattern to be recognized, an image having a maximum characteristic, and an image having a minimum characteristic. The technique carries out a process of matching of an object

5   image to be matched against the reference images to obtain a position where a peak degree of matching and degrees of matching of the object image. The technique carries out an interpolation process using the results of the matching process to produce a magnification of the object image.

10   The technique of the publication of the Unexamined Japanese Patent Application Publication No. Hei 10-126614 first detects a given mark contained in input image data, and then estimates a magnification given to the input image data on the basis of the size of the mark. The technique carries

15   out a process of normalizing the input image on the basis of the estimated magnification, and compares the result of the normalization with reference data to discriminate whether or not an object image is contained in the input image.

The technique of the publication of the Unexamined

20   Japanese Patent Application Publication No. Hei 9-81729 cannot handle the object images of patterns other than a circular pattern, however. There are cases that a pattern of the object image is not circular, that the object image is circular in pattern but the area within the circular contour contains

25   complex patterns, and that an image intentionally rotated is

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input. To cope with such, a matching process is needed for the rotated image. To realize the matching process for the rotated image by a hardware technique, a circuit for executing the matching process will be large in circuit scale. To realize the matching process for the rotated image by a software technique, a fairly large amount of calculations will be required.

In the technique of the publication of the Unexamined Japanese Patent Application Publication No. Hei 10-126614, as described above, complicated steps are required for the process to judge whether or not an object image is contained in the object image. Accordingly, the technique needs a complex process.

Further, to judge whether or not an object image is present in the input image, the input image or the image internally processed is temporarily stored in a memory. To this end, a large memory will be used indispensably.

SUMMARY OF THE INVENTION

Accordingly, an object of the present invention is to provide an image processing system and method which can discriminate a specific pattern to be recognized in an input image whose magnification is unknown, by use of a less amount of memory, and simple construction and process, and an image forming apparatus for making an image containing a specific

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pattern invalid.

The present invention provides an image processing system for processing an input image containing an object image of a predetermined pattern which may have been magnified, the image processing system, as shown in Fig. 21, comprising:

one or more characteristic quantity computing means for computing a characteristic quantity representative of a characteristic of an object image possibly contained in an input image; and

a plurality of magnification estimating means for computing a magnification on the basis of one or more characteristic quantities computed by and output from the one or more characteristic quantity computing means. The image processing system further comprises judging means for judging whether or not the object image is present in the input image, from the plurality of magnification levels estimated by the plurality of magnification estimating means. With this feature, even in a case where an object image having been magnified is contained in the input image, the image processing system reliably detects the object image.

In the image processing system, the judging means, as shown in Fig. 22, may judge whether or not the object image is present in the input image, from one or more characteristic quantities computed by the one or more characteristic quantity computing means and a plurality of magnification levels

estimated by the plurality of magnification estimating means. With this feature, even in a case where an object image having been magnified is contained in the input image, the image processing system reliably detects the object image.

5   The image processing apparatus or method thus constructed may be incorporated into an image forming apparatus. When an object image is present in the input image data, the image forming apparatus reliably is capable of making the image data invalid.

10   Thus, the image forming apparatus can exactly judge whether or not the object image is present even if it has been magnified. Accordingly, the image forming apparatus can reliably make the image data containing the object image invalid.

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BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an explanatory diagram showing an object image to be recognized in the embodiments of the present invention.

Fig. 2 is a block diagram showing an overall arrangement

20   of an image processing system which is an embodiment of the present invention.

Fig. 3 is a table showing a relationship between the size of the object image having undergone the resolution conversion, and the magnification.

25   Fig. 4 is a diagram showing a cut-out image area and

characteristic quantity (1) detecting areas for a characteristic quantity (1).

Fig. 5 is a diagram exemplarily showing characteristic quantity (1) detecting areas and magnification estimating areas for extracting characteristic quantities (1A) to (1D).

Fig. 6 is a block diagram showing an exemplar arrangement of magnification estimating means for the characteristic quantities (1A) to (1D).

Fig. 7 is a diagram exemplarily showing an extraction area in extracting a characteristic quantity (2).

Fig. 8 is a table showing relationships between the characteristic quantity (2) and magnification levels.

Fig. 9 is a diagram exemplarily showing an extraction area in extracting a characteristic quantity (3).

Fig. 10 is a table showing relationships between the characteristic quantity (3) and magnification levels.

Fig. 11 is a block diagram showing an exemplary arrangement of the judging means.

Fig. 12 is a general flow chart showing an image processing method according to the present invention.

Fig. 13 is a flow chart showing a process of extracting the characteristic quantity (1).

Fig. 14 is a flow chart showing a process of estimating a magnification on the basis of the characteristic quantity (1).

Fig. 15 is a flow chart showing a process of extracting the characteristic quantity (2).

Fig. 16 is a flow chart showing a for estimating a magnification on the basis of the characteristic quantity (2).

5 Fig. 17 is a flow chart showing a process for estimating a magnification on the basis of the characteristic quantity (2).

Fig. 18 is a flow chart showing a process for extracting the characteristic quantity (3).

10 Fig. 19 is a flow chart showing a synthetic judging process.

Fig. 20 is a block diagram showing an image forming apparatus which is an embodiment of the present invention.

Fig. 21 is a block diagram showing an overall arrangement

15 of the image forming apparatus.

Fig. 22 is a block diagram showing another overall arrangement of the image forming apparatus.

DETAILED DESCRIPTION OF THE PREFERERED EMBODIMENTS

20 An image to be recognized in an embodiment of the present invention is an object image shown in Fig. 1. The object image designated by reference numeral 1 consists of a circle and patterns located within the circle. The diameter of the circle of the object image is 10mm in a state that the object image

25 is not magnified or its magnification is 100%. It is readily

understood that the object image 1 is not limited to the illustrated one but its shape and size are appropriately selected upon occasion.

Fig. 2 is a block diagram showing an overall arrangement of an image processing system which is an embodiment of the present invention. In the figure, reference numeral 2 is specific color extracting means; 3 is resolution converting means; 4 is window processing means; 51 to 53 are characteristic quantity computing means 61 to 63 are magnification estimating means; and 7 is judging means.

The specific color extracting means 2 extract only a preset color from an input image. The resolution converting means 3 reduces a resolution of the input image from which the specific color was extracted by the specific color extracting means 2. In a specific example, the resolution converting means 3 is capable of reducing 600dpi of the input image to about 100dpi. Where the resolution is converted into 100dpi, the diameter of the object image 1 is 40 dots when the magnification is 100%.

With provision of the specific color extracting means 2 and the resolution converting means 3, the image data to be processed may be reduced in size. The size reduction of the image data will lessen the load in the subsequent process. If required, the specific color extracting means 2 and/or resolution converting means 3 may be omitted, as a matter of

course.

The window processing means 4 sequentially cuts a predetermined image area out of the image of which the resolution was reduced by the resolution converting means 3, and produces cut-out image areas. Fig. 3 is a table showing a relationship between the size of the object image 1 having undergone the resolution conversion, and the magnification. In case that an input image of 600dpi in resolution, which contains an object image 1 not magnified, is input to the image processing system, and that the resolution of the input image is converted into 100dpi, the object image 1 takes the form of a circle of about 40 dots in diameter.

When an input image containing the object image 1 having been increased or decreased in size is input to the image processing system, the object image 1 has the diameter which depends on the magnification as shown in Fig. 3. Accordingly, one may determine the size of the cut-out image area, which is cut out by the window processing means 4, while referring to the table.

As seen from the table, when the magnification is 120%, the diameter of the object image 1 is 48 dots. The cut-out image area is selected to have 48 dots x 48 dots. Thus, in this instance, the cut-out image area is a square of 48 x 48. However, the size and shape of the cut-out image area may be appropriately selected as needed. For example, the cut-out

image area may be analogous in shape to the object image 1. In this instance, the magnification is selected to be within a range of 80% to 120%. The magnification varying range may be broader than this range, if required.

5   The characteristic quantity computing means 51A to 51D, and the characteristic quantity computing means 52 and 53 each detect or compute something (referred to merely as "characteristic quantity") representative of a characteristic of the object image 1. In this instance, as will be described

10   later, those characteristic quantity computing means detect or compute a total of six characteristic quantities; peripheral information at four positions as characteristic quantities representing a shape of the object image 1, and ON pixel information and ON/OFF inverse information, which

15   represent the inner patterns of the object image 1. Specifically, the characteristic quantity computing means 51A to 51D detect the peripheral information of the object image 1, the characteristic quantity computing means 52 detects the ON pixel information, and the characteristic quantity

20   computing means 53 detects the ON/OFF inverse information.

While six characteristic quantities are detected or computed in this instance, the characteristic quantity may take any form if it represents a characteristic of the object image. The number of the characteristic quantities may also

25   be selected appropriately.

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The characteristic quantities (characteristic quantities 1A to 1D), which are detected by the characteristic quantity computing means 51A to 51D, represent a shape of the object image 1. Specifically, those characteristic

5 quantities are ON pixel information of magnification estimating areas (1) to (9), which correspond to the magnification levels in a characteristic quantity 1A detecting area, a characteristic quantity 1B detecting area, a characteristic quantity 1C detecting area, and a

10 characteristic quantity 1D detecting area, which will be described later in detail.

Specific examples of the characteristic quantity 1A detecting area, characteristic quantity 1B detecting area, characteristic quantity 1C detecting area, and characteristic

15 quantity 1D detecting area, and the magnification estimating areas (1) to (9) are diagrammatically illustrated in Figs. 4 and 5. A cut-out image area 41 shown in Fig. 4 is a cut-out image area cut out by the window processing means 4. The characteristic quantity 1A detecting area, characteristic

20 quantity 1B detecting area, characteristic quantity 1C detecting area, and characteristic quantity 1D detecting area, which are within the cut-out image area 41, are the areas used for simply detecting the circumference of the circle of the object image. The characteristic quantity 1A detecting area

25 and the characteristic quantity 1C detecting area are used for

detecting the periphery of the circle as viewed in the fast scan direction. The characteristic quantity 1B detecting area and the characteristic quantity 1D detecting area are used for detecting the periphery of the circle in the slow scan direction.

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As seen Fig. 3, the size (diameter) of the object image 1 varies depending on the magnification. Therefore, in each of the characteristic quantity 1A detecting area, characteristic quantity 1B detecting area, characteristic quantity 1C detecting area, and characteristic quantity 1D detecting area, the positions corresponding to the magnification levels, i.e., portions containing numerals in Fig. 5, are assigned to magnification estimating areas (1) to (9), respectively.

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In this instance, the magnification estimating area (1) corresponds to the position of 120% of the magnification. Similarly, the magnification estimating areas (2), (3), (4), (5), (6), (7), (8) and (9) correspond to the positions of 115%, 110%, 105%, 100%, 95%, 90%, 85% and 80%, respectively.

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Accordingly, when the object image 1 is cut out of the input image by the window processing means 4 where the characteristic quantity 1A detecting area, characteristic quantity 1B detecting area, characteristic quantity 1C detecting area, and characteristic quantity 1D detecting area, and the magnification estimating areas are set up as mentioned

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above, the positions on the object image 1 corresponding to magnification levels are extracted in the form of ON pixels.

In this instance, the four characteristic quantity (1) detecting areas for detecting the periphery of the object image 1 are located at four positions in the fast and slow scan directions. Those areas may be located at positions as obliquely viewed, and the number of them may be appropriately selected.

The output signals of the characteristic quantity computing means 51A to 51D are ON pixel information in the magnification estimating areas (1) to (9), which correspond to the magnification levels of the characteristic quantity 1A detecting area, characteristic quantity 1B detecting area, characteristic quantity 1C detecting area, and characteristic quantity 1D detecting area. The magnification estimating means 61 estimates a magnification of the cut-out image area 41 on the basis of the ON pixel information of the characteristic quantity computing means 51A to 51D.

Fig. 6 is a block diagram showing an exemplar arrangement of the magnification estimating means 61. In the magnification estimating means 61, signals output from the characteristic quantity computing means 51A to 51D are input to coincidence computing portions 61A to 61c, respectively. The coincidence computing portion 61A compares the ON pixel information received from the characteristic quantity

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computing means 51A to 51D, and checks if those four ON pixel

information are coincident with one another. When those

information are coincident with one another, the ON pixel

information decided to be coincident is output to an valid

5   coincidence-degree select portion 61H.

The computing portion 61B likewise compares the ON pixel

information received from the characteristic quantity

computing means 51A to 51D, and checks if three of those ON

pixel information are coincident with one another. The

10   coincidence computing portion 61C compares the ON pixel

information received from the characteristic quantity

computing means 51A to 51D, and checks if two of those ON pixel

information are coincident with each other.

The detect results by the computing portions 61B and 61C

15   are respectively output to error comparing portions 61D and

61E. Each of the error comparing portions 61D and 61E compute

differences or errors between the ON pixel information, which

are not coincident, output from the characteristic quantity

computing means 51A to 51D and the ON pixel information, which

20   are coincident, output from the same. When the errors are

within a preset range in a corresponding error register, when

the computed errors are within the preset error range of the

error register, the ON pixel information, which are incident,

are output from the computing portion 61B and the coincidence

25   computing portion 61C to the valid coincidence-degree select

portion 61H.

More specifically, it is assumed now that an error tolerable range to be set in the error register is ± 5%. When the ON pixel information output from the characteristic quantity computing means 51A to 51C indicate the position of the magnification estimating area (5), i.e., 100%, and the ON pixel information from the characteristic quantity computing means 51D indicate the position of the magnification estimating area (4), i.e., 105%, the computing portion 61B detects that three pieces of ON pixel information from the characteristic quantity computing means 51A to 51D are coincident with one another, and the error comparing portion 61D compares 100% as the ON pixel information output from the characteristic quantity computing means 51A to 51C with 105% as the ON pixel information from the characteristic quantity computing means 51D. As a result, the error is 5%. As recalled, the error tolerable range set in the error register is ± 5%. Therefore, 100% as the ON pixel information output from the characteristic quantity computing means 51A to 51C is output to the valid coincidence-degree select portion 61H.

The valid coincidence-degree select portion 61H determines whether or not the results output from the coincidence computing portion 61A, the error comparing portion 61D, and the error comparing portion 61E are valid, and selects the valid result with the aid of a valid

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coincidence-degree select register. And it outputs only the valid result to the judging means 7.

Description will now be given about a process of computing the ON pixel information as a characteristic quantity (characteristic quantity (2)), which represents the inner pattern of the object image 1, which the process is carried out by the characteristic quantity computing means 52. A circular area (corresponding to the object image 1 whose magnification is 120%) of 48 dots in diameter, hatched in Fig. 7, is first provided as a characteristic quantity (2) extraction area 42 within a cut-out image area 41 cut out by the window processing means 4. The characteristic quantity computing means 52 counts the ON pixels within the characteristic quantity (2) extraction area 42 for the image within the cut-out image area 41 and outputs the resultant to the are magnification estimating means 62.

The results of counting the number of the ON pixels of the object image 1, which corresponds to the magnification within the characteristic quantity (2) extraction area 42, are shown in Fig. 8. As seen from Fig. 8, the number of the ON pixels within the characteristic quantity (2) extraction area 42 varies depending on the magnification. When the object image 1 is present within the cut-out image area 41, a magnification corresponding to the object image 1 within the cut-out image area 41 cut out by the are magnification

estimating means 62 can be estimated on the basis of the number
of ON pixels within the characteristic quantity (2) extraction
area 42, which is counted by the characteristic quantity
computing means 52.

5   In a process of estimating a magnification corresponding
to the object image 1 within the cut-out image area 41, which
the process is carried out by the are magnification estimating
means 62, the number of ON pixels in the object image 1
corresponding to the magnification levels within the
10   characteristic quantity (2) extraction area 42 as shown in Fig.
8 are stored as a dictionary. The magnification is estimated
while referring to the dictionary for comparison.

In another magnification estimating process, the image
processing system contains a dictionary, which stores the
15   upper limit/lower limit of the number of the ON pixels in the
object image 1 corresponding to the magnification within the
characteristic quantity (2) extraction area 42. When the
number of ON pixels within the characteristic quantity (2)
extraction area 42 is between the upper limit/the lower limits
20   corresponding   to   the   magnification,   a   magnification
corresponding to the upper limit/lower limit may be estimated
to be a magnification of the cut-out image area 41.

A process of computing ON/OFF inverse information as a
characteristic quantity (characteristic quantity (3)), which
25   represents the inner pattern of the object image 1, which the

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process is carried out by the characteristic quantity computing means 53, will be described. As in the process of computing the ON pixel information, which is carried out by the characteristic quantity computing means 52, to compute the

5   ON/OFF inverse information, the characteristic quantity (3) extraction area is provided within the cut-out image area 41 cut out by the window processing means 4. The magnification estimating means 63 counts the inverted ON and OFF pixels in the fast and slow scan directions, and outputs the result of

10   the counting to the magnification estimating means 63.

In this instance, two directions, the fast and slow scan directions, are used for the direction to obtain the ON/OFF inverse information. If necessary, one or plural directions may be used for the same purpose. As shown in Fig. 9, ON and

15   OFF pixels in an image of a predetermined shape, such as an ON/OFF extraction area 44, within a characteristic quantity (3) extraction area 43, may be counted.

Fig. 10 is a table showing the results of counting ON/OFF inverse information of the object image 1 corresponding to a

20   magnification when the characteristic quantity (3) extraction area is changed to the characteristic quantity (2) extraction area 42. As seen from the table of Fig. 10, the number of ON/OFF inverse pixels within the characteristic quantity (2) extraction area 42 varies depending on the magnification.

25   When an object image 1 is present within the cut-out image area

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41, the magnification estimating means 63 may estimate a magnification corresponding to the object image 1 within the cut-out image area 41 on the basis of the number of ON/OFF inverse pixels within the characteristic quantity (2)

5   extraction area 42, which is counted by the characteristic quantity computing means 53.

A process by which the magnification estimating means 63 estimates a magnification corresponding to the object image 1 within the cut-out image area 41 resembles the magnification

10   estimating process of the magnification estimating means 62.

A block diagram showing an exemplary arrangement of the judging means 7 is shown in Fig. 11. In the judging means 7, magnification information output from the magnification estimating means 61 to 63 are input to coincidence degree

15   computing portions 71 and 72. The coincidence degree computing portion 71 compares the magnification information received from the magnification estimating means 61 to 63, and judges whether or not those pieces of information are coincident with one another. If the information are

20   coincident with one another, the judging means 7 judges that an object image 1 is contained in the cut-out image area 41, and outputs the result of the judgement to a valid coincidence degree select portion 75.

Similarly, the coincidence degree computing portion 72

25   compares magnification information received from the

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magnification estimating means 61 to 63, and judges whether or not the magnification information output from the magnification estimating means 61 to 63 are coincident with one another, and outputs the result of the judgement to an error

5   comparator portion 73.

The error comparator portion 73 computes an error or difference between the magnification information being not coincident that is output from the magnification estimating means 61 to 63 and the magnification information being coincident that is output from the magnification estimating

10   means 61 to 63. If the computed error is within a tolerable range set in an error register, the judging means judges that the error is within the tolerable range, and that an object image 1 is present within the cut-out image area 41, and outputs

15   the judgement result to the valid coincidence degree select portion 75.

Let us consider a case where the error tolerable range set in the error register is ± 5%, and the magnification information of the magnification estimating means 61 and 62

20   is 100% and that of the magnification estimating means 63 is 105%. In this case, the coincidence degree computing portion 72 detects that the magnification information of the magnification estimating means 61 to 63 are coincident with one another. The error comparator portion 73 compares 100%

25   of the magnification information of the magnification

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estimating means 61 and 62 with 105% of that of the magnification estimating means 63. As a result, it produces an error of 5%. This figure is within ± 5%. Therefore, the judging means judges that an object image 1 is present within the cut-out image area 41, and outputs the judgement result to the valid coincidence degree select portion 75.

The valid coincidence degree select portion 75 judges whether or not the processing results output from the coincidence degree computing portion 71 and the error comparator portion 73 are valid and selects only the valid result or results with the aid of a valid coincidence degree select register 76, and outputs the valid result or results.

Fig. 12 is a flow chart generally showing the image processing method of the present invention. An input image is input to the image processing system. Upon receipt of the input image, the image processing system starts an operation of detecting an object image. A step S1 is executed to extract only a predetermined color. A step S2 is executed to convert a resolution of the extracted color data extracted in the step S1 to another resolution. For example, 600dpi is converted into 100dip.

A step S3 is executed to cut out a cut-out image area out of the image data having undergoing the resolution conversion in the step S2. In this case, the size of the cut-out image area cut out is selected so as to allow the object image

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1 of the highest magnification level to be detected. In this

instance, the size of the cut-out image area is selected to

be 48 dots x 48 dots so as to allow the object image 1 of 120%

in magnification to be detected.

5   A step S4 is executed to extract a characteristic

quantity (1) of the object image 1 within the cut-out image

area cut out in the step S3. A step S5 is executed to estimate

a magnification on the basis of the characteristic quantity

(1) extracted in the step S4. A step S6 is executed to extract

10   a characteristic quantity (2) of the object image 1 within the

cut-out image area cut out in the step S3. A step S7 is executed

to estimate a magnification on the basis of the characteristic

quantity (2) extracted in the step S6.

A step S8 is executed to extract a characteristic

15   quantity (3) of the object image 1 within the cut-out image

area cut out in the step S3. A step S9 is executed to estimate

a magnification on the basis of the characteristic quantity

(3) extracted in the step S9. Here, it is assumed that the

characteristic quantity (1) contains the characteristic

20   quantities 1A to 1D used in the image processing system of the

embodiment. The characteristic quantities (2) and (3) are the

characteristic quantities (2) and (3) used in the image

processing system of the embodiment.

Fig. 13 is a flow chart showing a process of extracting

25   the characteristic quantity (1), which is executed in the step

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S4 in Fig. 12. An operation of extracting the characteristic

quantity (1) starts. A step S21 is executed to scan the pixels

within the cut-out image area. A step S22 is executed to check

if all the pixels have been scanned. If all the pixels are

5   not scanned, a step S23 is executed to scan the subsequent

pixels. The scanning operation is repeated till all the pixels

are scanned.

    After all the pixels with the cut-out image area are

scanned, a step S24 is executed to extract the ON information

10   of the pixels in the magnification estimating areas (1) to (9)

in the characteristic quantity 1A extraction area (Fig. 5).

Steps S25, S26 and S27, respectively, extract the ON

information of the pixels in the magnification estimating

areas (1) to (9) in the characteristic quantity 1B extraction

15   area, the characteristic quantity 1C extraction area, and the

characteristic quantity 1D extraction area (Fig. 5). A step

S28 outputs the ON information in the magnification estimating

areas in the characteristic quantity 1A extraction area, the

characteristic   quantity   1B   extraction   area,   ~~the~~

20   ~~characteristic   quantity   1D   extraction   area,~~   and   the

characteristic   quantity   1C   extraction   area,   and   the

characteristic   quantity   1D   extraction   area,   which   are

extracted in the steps S24 to S27, and the process of extracting

the characteristic quantity (1) ends.

25   Fig. 14 is a flow chart showing a process of estimating

a magnification on the basis of the characteristic quantity

(1) in the step S5 in Fig. 12. An operation of estimating a

magnification on the basis of the characteristic quantity (1)

starts.   A step S31 is executed to compare the ON pixel

5   information in the characteristic quantity (1) extraction

areas A to D, extracted in the step S4 (Fig. 12). When all

the comparing results are coincident with one another, a step

S38 is executed. When the results are not coincident, a step

S32 is executed.

10   When a detection is permitted on the basis of a preset

value in the step S32, a step S33 is executed to compare the

ON pixel information of the characteristic quantity (1)

extraction areas A to D, extracted in the step S4 (Fig. 12).

When three comparing results are coincident with one another,

15   a step S34 is executed to check if the area not coincident is

within a predetermined tolerable range. When it is within the

predetermined range, a step S38 is executed. In other cases,

a step S40 is executed. This step judges that the image within

the cut-out image area 41 is not the object image 1, from the

20   shape of the object image 1. A step S41 is executed to output

information stating that the image within the cut-out image

area 41 is not the object image 1, and the process under

execution ends.

When three comparing results are not coincident with one

25   another in the step S33, a step S35 is executed.   When a

detection is permitted on the basis of a preset value in the step S35, a step S34 is executed to compare the ON pixel information in the characteristic quantity (1) extraction areas A to D, extracted in the step S4 (Fig. 12). When two

5   of the comparing results are coincident with each other, a step S37 is executed to check the areas not coincident are within a predetermined error range. When those are within the error range, a step S38 is executed. In other cases, a step s40 is executed to judge that the image within the cut-out image area

10   41 is not the object image 1, from the shape of the object image 1, and then a step s41 is executed to output information stating that the image within the cut-out image area 41 is not the object image 1, and this process under execution ends.

The step S38 judges that the image within the cut-out

15   image area 41 is the object image 1, from the shape of the object image 1, and a step S39 is executed to output magnification levels of the characteristic quantity (1) extraction areas A to D, obtained in the step S4, and the process under execution ends.

20   A process of extracting the characteristic quantity (2) in the cut-out image area cut out in the step S3, which is executed in the step S6 in Fig. 12, is flow charted in Fig. 15. An operation of extracting the characteristic quantity (2) starts. Then, a step S51 is executed to scan the pixels

25   within the cut-out image area. A step s52 is executed to judge

whether or not target pixels to be scanned are present within

a characteristic quantity (2) extraction area 42 (Fig. 7).

When the target pixels are present within a characteristic

quantity (2) extraction area 42, a step S53 is executed to check

5   if the target pixels are the ON pixels.

When the target pixels are the ON pixels in the step S53,

a step S54 is executed to count them and then a step S55 is

executed. When the step S52 judges that the target pixels are

present within a characteristic quantity (2) extraction area

10   42 (Fig. 7), or when the step S53 judges that the target pixels

are not the ON pixels, a step S55 is executed. The step S55

judges whether or not the scanning of the cut-out image area

ends. When the scanning does not end yet, a step S56 is executed

to scan the subsequent pixels, and a sequence of the process

15   from the steps S52 to S55 is repeated. When the step S55 judges

that the scanning of the cut-out image area is completed, a

step S57 is executed to output a count value, and the process

under execution ends.

A process, which is executed in the step S7, for

20   estimating a magnification on the basis of the characteristic

quantity (2) extracted in the step S6, will now be described

with reference to a flow chart in Fig. 16. An operation of

estimating a magnification on the basis of the characteristic

quantity (2) starts. In turn, a step S61 is executed to compare

25   the number of ON pixels in the characteristic quantity (2)

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extraction area, extracted in the step S6, with the values in

a dictionary as shown in Fig. 8, and judges whether or not those

values are coincident with each other.

When those are coincident, a step S62 is executed to judge

5 that the object image 1 is present within the cut-out image

area, from the geometrical pattern of the object image 1. A

step S63 is executed to output a magnification corresponding

to the number of ON pixels, which is coincident in the step

S62, and the process under execution ends. When the number

10 of ON pixels in the characteristic quantity (2) extraction area,

extracted in the step S6 is not coincident with any of the values

in the dictionary as shown in Fig. 8, a step S64 is executed

to judge that the object image 1 is not present within the

cut-out image area, from the geometrical pattern of the object

15 image 1, and a step S65 is executed to output information

stating that the image within the cut-out image area is not

the object image 1, and the process under execution ends.

A process for estimating a magnification on the basis

of the characteristic quantity (2), which is executed in the

20 step S7 in Fig. 12, may be constructed as in a flow chart shown

in Fig. 17. An operation of estimating a magnification on the

basis of the characteristic quantity (2) starts. A step S71

is executed. This step compares the number of ON pixels in

the characteristic quantity (2) extraction area, extracted in

25 the step S6, with the contents of a dictionary containing the

upper and lower limits of the number of ON pixels in the object

image 1, which corresponds to magnification levels in the

characteristic quantity (2) extraction area 42. The step S71

judges whether or not a count value is within a threshold value

5   range stored in the dictionary. If it is within the threshold

value range, a step S71 is executed to judge that the object

image 1 is present within the cut-out image area, from the

geometrical pattern of the object image 1, and then a step S73

is executed to output a magnification level corresponding to

10   the threshold value within which the count value falls, and

the process under execution ends.

When in the step S71, the number of the ON pixels in the

characteristic quantity (2) extraction area, extracted in the

step S6, is out of the threshold value range stored in the

15   dictionary, a step S74 is executed to judge that the object

image 1 is not present within the cut-out image area, from the

geometric pattern of the object image 1, and a step S75 is

executed. This step outputs information stating that the that

the object image 1 is not present within the cut-out image area

20   41, and the process under execution ends.

A process, executed in the step S8 (Fig. 12), for

extracting the characteristic quantity (3) within the cut-

out image area cut out in the step S3 is flow charted in Fig.

18. An operation of extracting the characteristic quantity

25   (3) starts. A step S81 is executed to scan the pixels within

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the cut-out image area. A step S82 is then executed to check
if the target pixels to be scanned are present within the
characteristic quantity (3) extraction area. When the target
pixels to be scanned are present within the characteristic

5   quantity (3) extraction area, a step S83 is executed to judge
if the target pixels and the pixel preceding to the former as
viewed in the fast scan direction are inverted in ON/OFF state.

When the step S83 judges that the target pixels and the
pixel preceding to the former as viewed in the fast scan

10   direction are inverted, a step S85 is executed. Similarly,
when the target pixels are present within the characteristic
quantity (3) extraction area in the step S82, a step S84 judges
if the target pixels and the pixel preceding to the former as
viewed in the slow scan direction are inverted in ON/OFF state.

15   When the step S84 judges that the target pixels and the
pixel preceding to the former as viewed in the slow scan
direction are inverted, a step S85 is executed. The step S85
counts the number of the inverted pixels present as viewed in
the fast and slow scan directions. When the step S82 judges

20   that   the   target   pixels   are   not   present   within   the
characteristic quantity (3) extraction area or when the steps
S83 and S84 judge that the target pixels and the pixels
preceding to the former as viewed in the fast and slow scan
directions are not inverted in ON/OFF state, a step S86 is

25   executed.

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The step S86 judges whether or not the scanning for the cut-out image area is completed. When not completed, a step S87 is executed to scan the subsequent pixels. A sequence of the process from the steps S82 to S86 is repeated. When the step S86 judges that the scanning of the cut-out image area is completed, a step S88 outputs a count value and the process under execution ends.

A process of the step S9 for estimating a magnification on the basis of the characteristic quantity (3) resembles the process of the step S7 for estimating a magnification on the basis of the characteristic quantity (2). Hence, description of the step S9 process is omitted.

A flow chart showing a synthetic judging process of a step S10 in Fig. 12 is shown in Fig. 19. The synthetic judging process starts. Then, a step S91 compares the magnification levels computed in the magnification estimating steps S5, S7 and S9 for the characteristic quantities (1) to (3). When all the comparing results are coincident with one another, a step S91 is executed. In other cases, a step S92 is executed.

When a detection is permitted on the basis of a preset value in the step S92, a step S93 is executed to compare the magnification levels computed in the magnification estimating steps S5, S7 and S9 for the characteristic quantities (1) to (3). When those are coincident with one another, a step S94 is executed to check if the area, not coincident, is within

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a predetermined error tolerable range. If it is within the tolerable error range, a step S95 is executed. In other cases, a step S97 is executed to judge that the image within the cut-out image area 41 is not the object image 1, and a step S98 is

5 executed to output information stating that the image within the cut-out image area 41 is not the object image 1, and the process under execution ends.

The step S95 judges that the image within the cut-out image area 41 is the object image 1, and the step S96 outputs

10 information stating that the image within the cut-out image area 41 is the object image 1, and the process ends.

Fig. 20 is a block diagram showing an image forming apparatus which is an embodiment of the present invention. In the figure, reference numeral 81 is an image forming apparatus;

15 82 is a control unit; 83 is an interface; 84 is an image processing unit; 85 is an image forming unit; and 86 is a recognizing unit.

The control unit 82 controls the relative portions for forming an image on a recording medium in accordance with input

20 image data. In particular when the recognizing unit 86 judges that an object image is contained in the image data received by the interface 83, the control unit carries out a process of making the image data invalid.

The interface 83 receives image data from an external

25 device, such as a personal computer. There is a possibility

that an object image, which is inhibited from being visualized,

is contained in the image data received. The image data may

be the image data of a magnified original image.

The image processing unit 84 carries out a variety of

5   processes for image formation. There is a case that no image

processing is required in the image forming apparatus, for

example, it receives image data having variously been

processed in the external device. In this case, the image

processing unit 84 may be omitted.

10   The image forming unit 85 forms an image on a recording

medium. An appropriate method may be used for forming the

image. When receiving an invalidating instruction from the

control unit 82, it forms an image in accordance with the

instruction.

15   The recognizing unit 86 may employ the above-mentioned

unique construction. Specifically, the recognizing unit

judges whether or not an object image is present in input image

data, and outputs the resultant data to the control unit 82.

In this case, even wen the input image data has been magnified,

20   the object image can be detected as described above.

An operation of the thus arranged image forming apparatus

will be described. The interface 83 receives image data from

an external device, such as a personal computer. The image

processing unit 84 processes the image data in a predetermined

25   manner. Then, the image forming unit 85 forms an image on a

recording medium. In the operation, the interface 83, the image processing unit 84 and the image forming unit 85 are under control by the control unit 82.

The image data that is received by the interface 83 is also input to the recognizing unit 86. The recognizing unit 86 judges whether or not an object image is present in the input image data, and outputs the resultant data to the control unit 82.

When the recognizing unit 86 judges that the object image is present, the control unit 82 carries out a process of making the input image data invalid. An example of the invalidating process is to generate given data to paint out the whole output image with predetermined color, and the image forming unit 85 forms an image of the generated data. In an alternative, the recognizing unit prohibits the image forming unit 85 from generating the received image data, thereby prohibiting the image formation.

Thus, the image data containing the object image may be controlled so that it is directly used for image formation. In this case, if the image data has been magnified, the magnified image data can reliably be recognized by applying the image processing system of the invention to the recognizing unit 86, and the invalidating process may be carried out.

As seen from the foregoing description, an object image of a specific pattern, even if magnified, can be reliably

detected.   Even when the magnified image data is received, the image forming apparatus of the invention recognizes it and carries out the invalidating process.